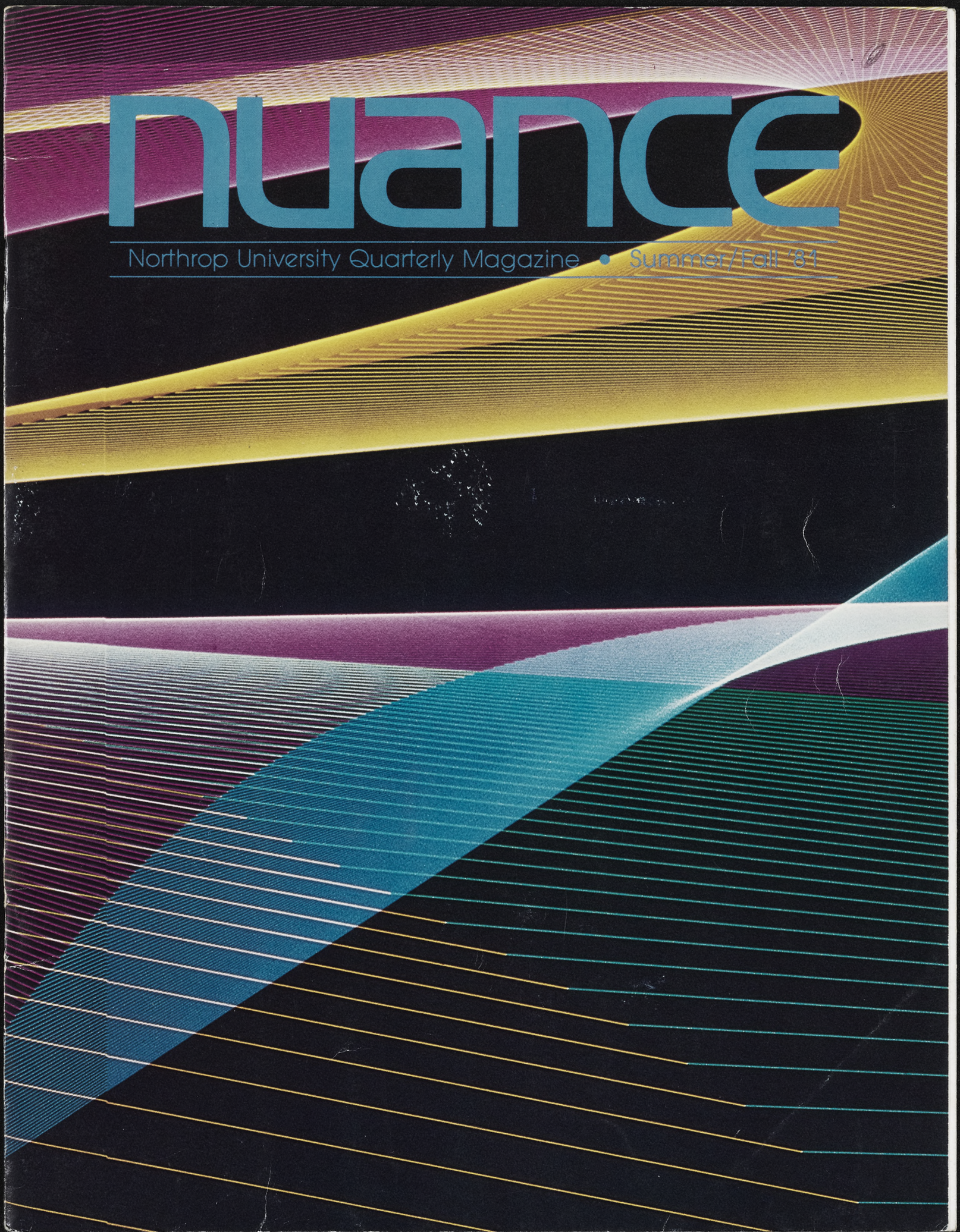
nuance
Northrop University Quarterly Magazine • Summer/Fall '81

Editor's Note

This issue of **Nuance** marks a special moment in Northrop University's history. The eve of the University's 40th anniversary coincides with the 40th anniversary of jet propulsion, the boom of computer-aided design and manufacturing, the initiation of advanced avionics in commercial airliners, and the dramatic success of the first solar-powered aircraft to be piloted across the English Channel.

Nuance has taken a close look at each of these advancements and found a faculty member, trustee, or alumni making headline contributions in each field. This issue is a kaleidescope of University involvement with industry. The spirit of the times seems to welcome, and even demand, an active, solution-oriented education. In response, Northrop University is making science and technology the business of education.

Michelle O'Daniel

The President's Message

Roots of the modern university are found in Bologna, Italy, where around the year 1100, students hired teachers for demonstration lectures and then organized a school. These students wanted relevant information on the three professions of the day — law, medicine, and theology.

Nine centuries later, American higher education, especially in the Universities, still seeks to meet the needs of students whose primary concern is the world of work.

Northrop University, an uncommon place, is engaged in life-work preparation in the professional fields of engineering, engineering technology, business management, and law. In comparison with other universities, Northrop is relatively young, having been founded in 1942, and relatively small, having only 1900 students. As a private, non-tax supported, non-profit institution, Northrop University depends for its financial support on those who believe that independent educational institutions should continue to exist and prosper in order to serve present and future generations.

The unique dimension to a degree from Northrop University is the immediate career possibilities it offers. With a faculty involved in industry related research, the student receives what Northrop University calls achievement-oriented education.

Many industries and individuals are already cooperating actively with the University in mutually beneficial programs. For those who share our sense of educational commitment, we offer **Nuance,** Northrop University's Quarterly Magazine, which reflects our goals and achievements. We would like to extend this issue as an introductory invitation to join the University's active supporters.

The many ways we can work together include corporate management outreach programs, advisory councils, research projects and financial investment in various educational and advanced technology programs.

We respectfully invite your participation.

Dr. B.J. Shell
President,
Northrop University

nuance

Number Three

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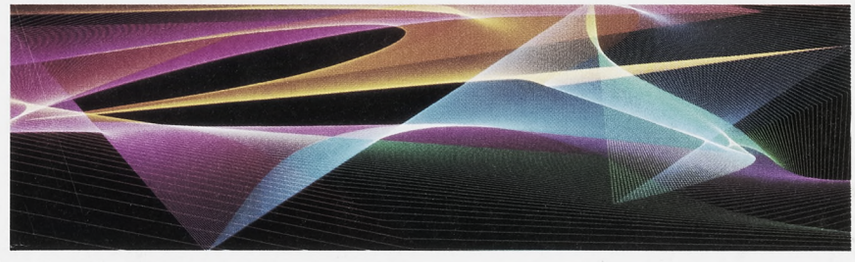

on the cover: Melvin L. Prueitt, a staff member at the Los Alamos Scientific Laboratory, is now internationally known for his computer program called PICTURE which is capable of generating aesthetic forms from numbers. This particular computer art work is three times the length of a usual panel.

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All inquiries or contributions concerning Alumni of Northrop University should be forwarded to Raul Alvarado, Jr. or Carl Pearse, c/o Career Center, Northrop University, Inglewood, California 90306, (213) 641-3470, extension 232.

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GROW WITH NORTHROP UNIVERSITY

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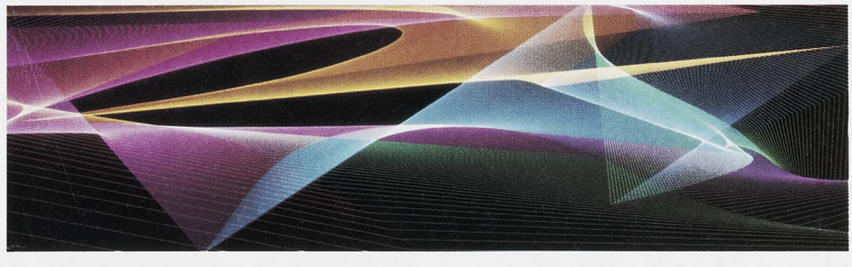

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Michelle O'Daniel

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Volume Two Number Three

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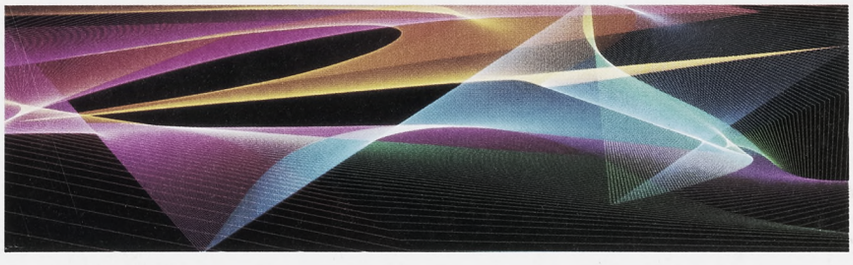
Located in Inglewood, California, Northrop University is an independent, co-educational institution offering a diverse curriculum of graduate and undergraduate programs in the professional fields of Engineering, Engineering Technology, Business and Management, Language Studies and Law.



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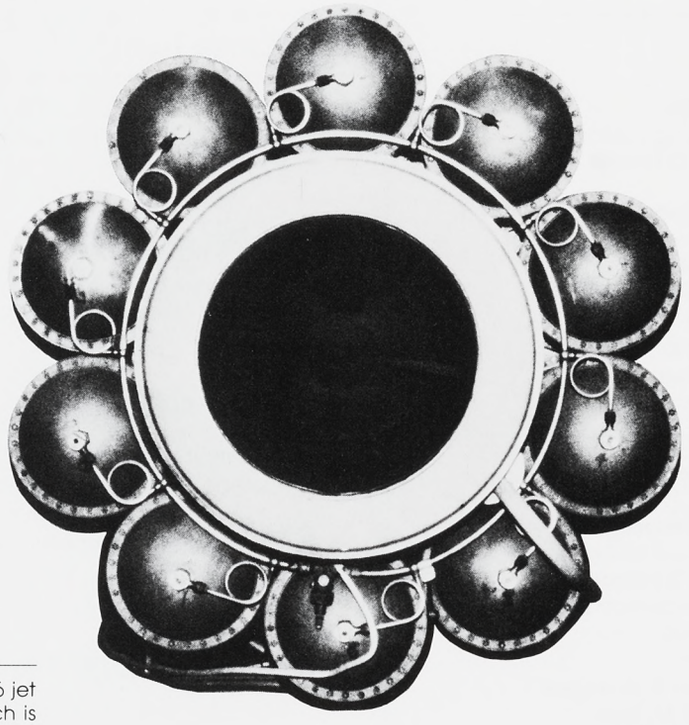
Four hundred passengers board a single airplane for a transpacific flight. An Air Force officer takes off on a military mission to fly, almost unbelievably, three times the speed of sound. A helicopter lifts a work crew to their oil drilling platform twenty miles offshore.

All involve flight, the use of aerodynamic forces demonstrated by the Wright brothers at Kitty Hawk in 1903. But each uses a much more recent propulsion technique, jet propulsion, introduced to the United States only 40 years ago. Its history is younger than many of us, but jet propulsion rapidly has become the accepted norm. To many, aircraft and jet are synonymous.



One of the original I-16 jet engines built in 1943, which is now running beautifully at the Institute of Technology.

Jet Propulsion

A Fortieth Anniversary

by
Everett T. Welmers
Dean, College of Engineering

PRELUDES

The preludes for jet propulsion are not found in this country, but in Germany, Italy, and Great Britain. The United States was the recipient, not the generator, of the concept. The genius of our capability has been expressed in the development and application of jet engines, large and small, for commerce, defense and pleasure - not in their invention.

In Germany Hans von Ohain patented a turbojet design in 1935. Two years later, March, 1937, a 550 pound thrust engine was demonstrated. As World War II was beginning, Erich Warsitz flew the first jet aircraft, the HE 178, on August 27, 1939. This was powered by a single engine, the HE S-36, which produced 1100 pounds of thrust. On April 2, 1941, the first flight of the twin engine HE 280VI took place. Two years later, in 1943, the Germans had an operational jet fighter.

In Italy, Campini had begun development of a jet engine in 1933. Initially it required more power to run than the jet thrust it produced. However, on August 27, 1940, the first flight of the Campini-Caproni CC-2 took place. A reciprocating engine in the fuselage drove the compressor which produced the thrust.

In England, as early as 1928, a young cadet in the Royal Air Force College at Cranwell, named Frank J. Whittle, wrote a paper discussing gas turbines and jet propulsion. In January, 1930, he applied for a patent (No. 347, 206) on a gas turbine for jet propulsion. A few years later, after unsuccessful attempts to interest government and industry, he failed to renew the patent; supporting a family during the depression seemed more important. However, in May 1935, a group became interested in developing the idea, and Power Jets Ltd. was formed. A year later the company ordered its first engine from British Thomson Houston Co. On April 12, 1937, tests began on this engine, called the WU.

Two years later, the British government became interested. In July, 1939, it ordered W.I. engines, which were to produce 850 pounds of thrust from Power Jets, and an

aircraft, the E 28/39, from Gloster Aircraft Co., Ltd. The first engine tests on the W.I took place in December 1940. The first aircraft taxi tests, using an engine assembled from discarded parts, took place on April 7, 1941. Philip E.G. Sayer was the pilot on the first flight, May 15, 1941.

In these days, it is particularly significant to note that during the critical days of a war for survival, Britain was able to fly an airplane with a totally new powerplant in less than two years from initial order.

ROOTS OF THE U.S. PROGRAM

During the 1930's the United States concentrated on developing turbo-superchargers for reciprocating engines. On June 5, 1937, a Northrop Gamma flew from Kansas City to Dayton at 37,000 ft., an altitutude impossible without supercharging.

Influenced by numerous papers and studies on gas turbines and aircraft jet propulsion by U.S. companies, General H. Arnold, U.S. Army Corps, wrote to Dr. Vannevar Bush, head of NACA, on February 25, 1941, proposing a program on jet research. In March, Dr. Bush created a special committee on jet propulsion. Within four months NACA awarded contracts to:

Allis Chalmers ..... Ducted Fan
Westinghouse ..... Turbojet
General Electric ..... Turboprop
(eventually the TG-100)

Other companies, including Boeing, worked on jet engine designs; most were discouraged from proceeding because of higher priority military tasks.

BRITISH—U.S. MERGINGS

By May, 1941, General H. Arnold had seen the Whittle jet engine and the Gloster airplane, and late that month had witnessed a short flight. As a result, U.S.-Great Britain discussions began. British representatives included: Lord Beaverbtook, Sir Henry Tizard, Col. Moore-Brabizon, and Sir Charles Porter. General Electric, with its experience in steam turbines and turbo-superchargers, seemed to be an appropriate U.S. company to become involved in engine development. D. Roy Shoults of G.E. was in England at the time working on B 17-C turbo-supercharger service and use. He, Col. A.J. Lyon, Gen. Arnold's technical representative in England, Major Carl Brandt from Col. Lyon's office, and Major Donald J. Kiern, an Air Corps power plant specialist, began discussions with Power Jets, Whittle, and Gloster Aircraft in July, 1941.

Then, on September 4, 1941 (40 years ago), an historic meeting took place in Washington. Under the highest secrecy, government, military, and General Electric representatives were assembled. General Arnold took drawings, design data, and reports on the Whittle engine from his safe and told the group, "Arrive at any decision you please, as long as G.E. accepts a contract to build 15 of these engines." Bell Aircraft Corporation was selected to build the aircraft.

That evening, "Larry" Bell received a call from Gen. Arnold's office asking that he be in Washington the next morning. He hurriedly called Harland Poyer, Bell's chief engineer, and the two left by train for Washington late that evening. In those meetings on September 5, first with Gen. Echols and later with Gen. Arnold and Roy Shoults, an agreement with Bell Aircraft was made for three twin engine aircraft. Based on 8½"x11" free hand sketches of the engine, a handful of Bell engineers prepared a proposal and built a model in two weeks.

Delivery schedules were extremely tight. G.E. was to build and test the engines in six months. On September 30, a Bell contract for three aircraft and a wind tunnel model was approved by Gen. Arnold and by the Undersecretary of War three days later. Cost was to be $1,644,431 and delivery was scheduled within eight months. Col. Chidlaw was approinted project director; Ray Whitman, a Bell vice president, was the Bell liaison; Major Ralph R. Stafford and Major Donald J. Kiern from Wright Field were the aircraft and engine project officers respectively.

G.E. AND THE ENGINES

One of the agreements with the British was that an engine would be sent to the United States which could be copied. On October 4, 1941, a B-24 landed at Bolling Field with the WIX engine concealed under the floor boards in its bomb bay. This engine was used in the initial Gloster aircraft flight, and had logged 132 hours. But U.S. Customs was not particularly cooperative, demanding an inspection of the cargo. Because of security, Major Keirn and three Power Jet representatives refused. A compromise was finally reached: Customs would count the boxes, but not look inside.

G.E. found that the engine could not be copied directly, but required considerable redesign. A reinforced concrete test chamber was built inside an existing building for security purposes. there was a heavy steel door for access, a small observation slit, and an exhaust into an unused 64 foot chimney. Appropriately, this test chamber came to be known as "Fort Knox."

(Continued on page 7)

Jet propulsion is an example of the rapidity with which technology can progress. In 1941, the direction of military and commercial aviation was changed by a British gas turbine and a United States decision to build a jet fighter.

interview

JOHN WRIGHT

Entrepreneur in the Computer Revolution

In a bright, cool room of the Automated Design Center, a brilliant young computer is at work, plotting engineering designs five times faster than the human hand. The lines, angles, and shaded areas are inked into a master plan at a speed of 30 inches per second. John Wright, President of the Automated Design Center, stands behind the computerized drafting board and begins to explain the new wizardry, popularly known as CAD/CAM, which is changing the future of manufacturing around the world. He begins his story, pointing back to the skillfully programmed drafting table. "For someone who never did relish long hours over a drafting table," he smiles, "this type of robot is a long-awaited wonder." Without pausing for rest, the mechanical hand of the Cal Comp 950 plotter etches out a complicated design in 16 minutes. "That same project might take nine weeks by an engineering design team," Wright continued. This type of robot does away with all the tools of the draftsman: the pencils, slide rules, triangles and long hours standing at the table." But the best part of his high tech demonstration was the revelation that the drawing was being "remoted" over the telephone lines from a graphic work station in San Diego.

I wanted to set up a computer convenience center which would provide multi-terminal systems to many small businesses throughout Southern California," Wright said as he indicated the small, dark rooms with bright video screens. "At a monthly rate of about $2,500 a company's engineers have access to a graphic work station, computerized drawing boards, and about $800,000 worth of computer systems," Wright explained. Within the next year, Automated Design Center expects to "remote" from every area in Southern California.

Right now, inside the dark work stations of the Center, video screens flash their green cursors in the intricate designs for nuclear energy plant construction, bridges, bolts, and even the fantasy starship designs for television. The Computer Aided Design system enables the engineer to rotate the part on the video screen, separate it into segments, or enlarge it up to 50,000 times. The ability to do analysis in the designing stage on the CAD system permits a part to be redesigned long before it has to be manufactured, saving industry considerable cost and time. Enthusiasts of the CAD/CAM systems predict that not since the use of electricity will production be able to increase as it will with the new computer-aided technology.

John Wright could be justly called a pioneer in the computer-aided design and manufacturing industry. He didn't plan to be. It happened quite by historical accident that his career and the commercialization of computers co-incided. Actually, John Wright was trained and educated in aeronautical engineering. Graduating from Northrop University in 1954, he fully expected to work behind a drafting table when North American hired him. Instead, he was set to work on something called "a computer." At that point, John Wright's future was determined. He immersed himself in the study of systems analysis

and within ten years he started his own software consulting firm, United Computing Corporation, which was eventually bought by McDonnell Douglas and is today one of the forerunners of the CAD/CAM vendor industry

Heralded by the international finance media as the fastest growing industry around, the CAD/CAM vendors expect a national sales total of $750 million this year and $2.2 billion by 1984. John Wright sees a little further into the future and predicts there will be the time "when every manufacturing company is going to need access to the cost-saving CAD/CAM systems." At this time, Wright intends to be prepared for the need with Automated Design Centers spread across the United States much as McDonald franchises. "This will allow the smaller businesses to save the initial cost of a CAD/CAM investment, by providing them with the use of a graphic design terminal, computer drafter, and memory discs." A unique idea, the Center is only in its second year.

Having such a far-reaching economic and technological impact on industry, the use of CAD/CAM is also expected to revolutionize the engineering curricula around the world. As an alumnus and trustee of Northrop University, John Wright gave **NUANCE** his personal forecast for the related futures of engineers, education, and computers. He began the interview with the encouraging observation he had made of his own life: "I think it is a tribute to my engineering background that I can run a business and serve as its president. I think the engineer is in an excellent position to become an entrepreneur. With the highly technical engineering products today, the engineer is in the unique position to understand the product and its manufacturing process."

As an alumnus and trustee of Northrop University, John Wright gave **NUANCE** his personal forecast for the related futures of engineers, education, and computers.

NUANCE: Did they have Computer Science when you were in school?

Wright: When I got out of school, they didn't even use the word "programmer." North American said they were going to hire me in to "set up computers." It was kind of amusing that I didn't want to go into drafting when I got out of school and now my whole life is concerned with computerized drawing. When I graduated from Northrop Institute of Technology in 1954 in Aeronautical Engineering, I was hired by North American to work and help set up this new thing called "a computer." I had no idea what that meant.

NUANCE: How are the CAD/CAM systems going to affect the engineer's education today?

Wright: Now, computers are going to have a big effect on the way engineers are trained. For instance, it didn't used to be important for engineers to know typing. Now, the engineer will have his own keyboard in front of him to work on his drawing and its dimensions. Something that has become very important is spatial geometry capabilities. The engineer will be more concerned in the future with the product and its design rather than in his own artistic drawing skills or ability to render a product manually on a piece of paper. His profession will be more integrated into the manufacturing.

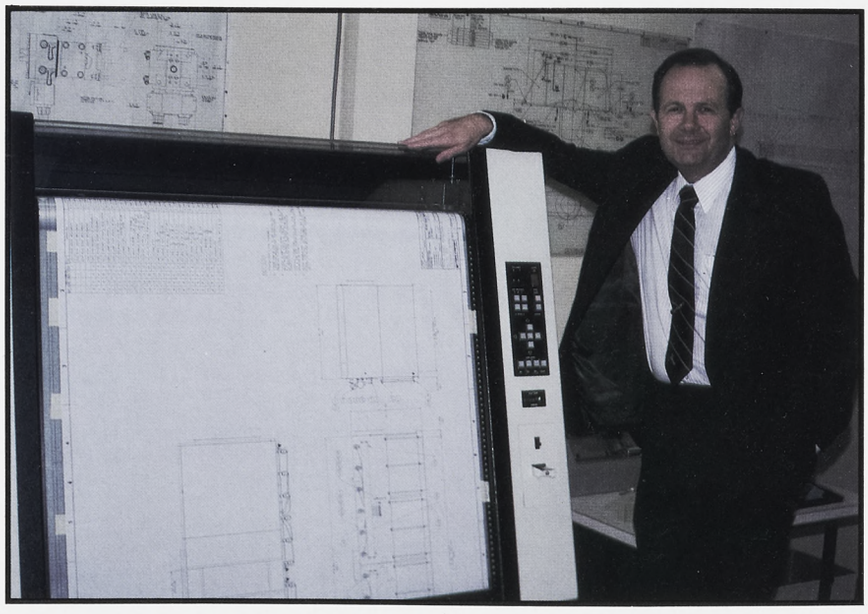
NUANCE: How do you see this change in the engineer's professional role coming about?

Wright: As I said, the engineer will be much more integrated into the entire system of production, from design to manufacturing. With a set data base to put the drawings out, he can change chairs with the manufacturing engineer who can go in and say, 'I want to run a milling machine over this surface and these are the cutting speeds and so forth.' It will then be put on a tape and into the numerical control machine which will cut the part out of raw metal. So, the same description of the part which is in the computer as a numerical drawing can be used for the manufacturing. And in addition, the same geometry which is in the computer for the drawing can be built into a finite element model which is an engineer's way of describing continuous geometry with numbers. Then you can solve the partial differential equations for stress and strain and heat distribution all from the same part definition. So, you can get the engineering analysis out of it as well as the manufacturing and engineering drawing.

Basically, the CAD/CAM system provides a central engineering data base which is available to all disciplines of the manufacturing company.

NUANCE: What does this integrating of the systems mean to a manufacturing company?

Wright: A standard data base means there is less chance for error in the handling of information. If you just hand a bunch of papers to a manufacturing engineer, he may interpret them incorrectly, but if he is given a graphics data base, the chance for "hand over" error is much less. The analytical engineer as well as the manufacturing



John Wright, President of Automated Design Center in Torrance, shows how the computerized drafting board executes a complicated design in just sixteen minutes.

engineer will be working from the same design foundation.

It is just a foregone conclusion that all companies will eventually be using these systems. Architects use them. Civil Engineers use them. CAD/CAM provides an analytical device as well as a drafting machine. You can ask it about volumes and weights and moments inertia.

Anything you draw can be stored in the computer's memory so that as the designer uses it over the years, he builds up a massive reservoir of drawings and patterns. When he has to design something new, he may start from a drawing developed a year ago, most of which will already be checked out for accuracy.

What you are really doing is increasing the productivity which means you are fighting the factors that increase costs. That is why these developments are so attractive.

NUANCE: What is the future for computer automation?

Wright: Robotics are now coming into full use in industry. Computer graphics and numerical control are accepted tools. The President's new tax plan encourages more investment in capital equipment, which in turn encourages companies to move forward into automated technology. This is going to cause a new phenomenon. Machinery is coming into engineering departments making them capital intensive just like manufacturing departments.

I see a trend coming over the next few decades which will see a lot of companies making capital intensive departments out of their engineering groups. Engineering companies will become entities within themselves. Their products will be engineered designs. One engineering company will serve a number of manufacturers.

You see, this capital intensive engineering equipment will have to be used constantly. It's a big investment. Like manufacturing equipment, it will have to be used year round serving several manufacturers. Of course, the larger companies can utilize this equipment themselves.

So I think you are going to see the emergence of engineering companies as independent design and testing centers serving several manufacturers.

NUANCE: What made you start a business in the computer industry?

Wright: Well, I wasn't particularly fond of working behind a drafting table. And the very first day I went in to work at North American, I was exposed to this new device called a computer. It was a new technical area. I decided to make a career out of it.

I was just 29 when the first computer software companies started to enter the market as independent entities. I saw the opportunity to participate in the new field, and in 1963 with friends, I started the United Computing Corporation, a software consulting firm.

I was the first employee and then president of the company for 17 years. When finally merged into McDonnell Douglas, we were doing $7-8 million a year in sales.

NUANCE: Is there any one particular key to your company's growth and success?

Wright: It's always an advantage to anticipate what is needed and to be able to be among the first to provide it. Numerical control of machine tools came into its own in the 50's and early 60's. Large computers were being used to program NC machines. The comptuer language used to develop the control tapes for these machines is called APT. The advent of the mini-computer allowed us to put the APT language on a system that the small shop could afford. We called our version of APT, UNIAPT, for United's APT.

Today, you find the UNIAPT in companies all over the world.

NUANCE: What kind of effect did this successful product have on United Computer Corporation?

Wright: The success of UNIAPT allowed us to become a public corporation and sell stock in our investment. With the proceeds we received in 1972 we were able to implement a design system on the smaller computers and that was called UNIGRAPHICS. The two products teamed up to form our entry into the CAD/CAM business.

NUANCE: Why did you decide to sell United Computing Corporation to McDonnell Douglas?

Wright: I think the main reason was the growth requirement. It takes millions and millions of dollars in investment to grow in the CAD/CAM business. We needed to join with someone in order to grow.

So, about 1976, United Computing Corporation was acquired by McDonnell Douglas Corporation and became a wholly-owned subsidiary. I was president of that subsidiary for about three years. After that period, it was merged completely into McDonnell Douglas and I moved on to start Automated Design Centers.

NUANCE: Could you explain what an Automated Design Center is?

Wright: It is basically a walk-in center for designers to come in and work out their designs on the graphics terminals. After the design is done, they punch a button and their design is transferred to the on-line drafting equipment. This computerized drafting machine draws at very high speeds in ink and prints out with a high degree of accuracy. The design data base is then also stored on mag tape or disc.

Right now, we are starting to venture out from the idea of just a walk-in center. We are locating our graphics terminals remotely at our computer sites. Instead of walking into the studio, the designer can "remote" his drawing over the telephone to the central computer here at the Design Center.

NUANCE: You are an alumnus of Northrop University, as well as a member of the Board of Trustees. What do you see as your special role with the University?

Wright: I've been on the Board of Trustees for over ten years. I've seen the University expand and contract and respond to society's needs. its strength is in its special ability to respond quickly with solar energy programs, engineering technology programs and now computer technology.

Part of my role as a board member is to bring to the University's attention industry's requirements for future employees. This communication link is essential. In that sense, I feel the Board is the directional guide of the University, the indicator of new directions. nu

Jet Propulsion

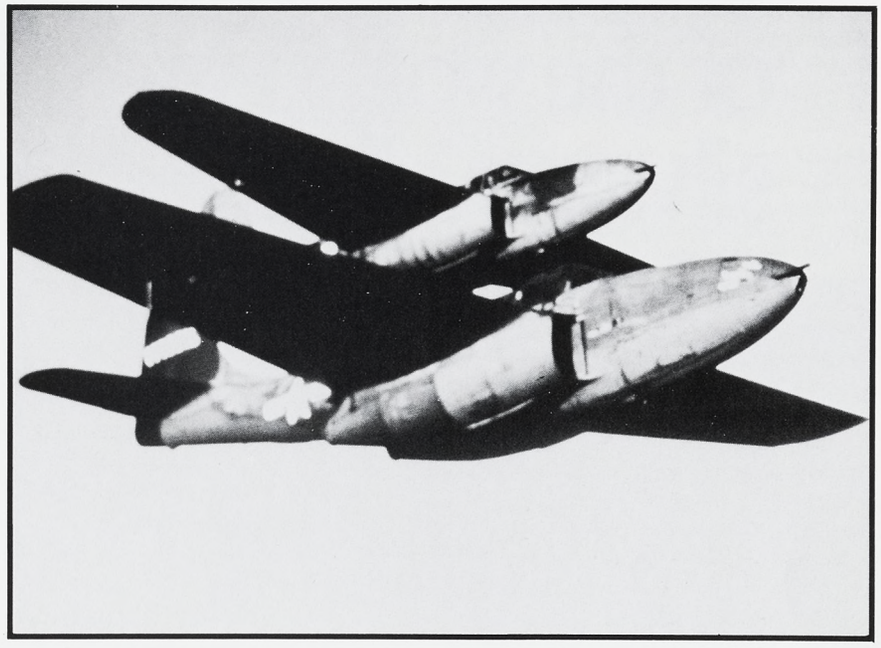
Continued from page 3

BELL AND THE AIRPLANE

Bell Aircraft designated the new airplane the XP-59A. The number was borrowed from an experimental design for a twin tail-boom pusher type, 450 m.p.h., airplane, called the XP-59. Originally two were ordered, but the program was cancelled on December 1, 1941. Work on the XP-59A began in the old Pierce Arrow facilities in Buffalo. Then, under the highest level of security, the upper floors of a Ford Motor Company facility on Main Street in Buffalo were remodeled for production. Eventually, walls on the second floor were knocked out to permit loading the aircraft sections onto railroad cars. Only a few Bell employees at the main facility knew what was being built on Main Street.

On March 26, 1942, prior to completion of the first airplane, Bell received an order for 13 of the XP-59A, including wind tunnel models, a static test airplane, and spares. The total contract was $2,670,377.16.

In August, 1942, the 1-A engines were first mated with the airplane. A month later, September 12, the airplane left Buffalo on its way to a remote test base at Rodgers Dry Lake, Muroc, California (now Edwards Air Force Base), arriving on the 19th.



The Bell P-59S in flight

THE FIRST FLIGHT

G.E. was concerned that the long ride on rough rails would damage the bearings and shafts, which had been machined to fine tolerances. To prevent this, a gas driven air compressor was used to turn the engine slowly on the long trip. Three G.E. engineers and five security guards loaded mattresses, blankets, and canned food onto the freight cars and "rode the rails" across country.

On September 26, the engines were run up for the first time in the airplane. Four days later, Robert Stanley, Bell's chief test pilot, made taxi runs. Then on October 1, the first U.S. jet took off, making four flights with its landing gear down, at altitudes of less than 100 feet. The next day four more flights were made at altitudes of up to 10,000 feet. Bob Stanley again was the pilot except for the third flight, when Lt. Colonel L.G. Craige was at the controls. The second airplane flew in February, 1943.

During that winter, rains descended and the "dry lake" became a shallow water-filled lake. Hawes Field (now George AFB), about 35 miles away, was dry enough for flying. The jet was towed to its new test site, a tarpaulin covering the forward fuselage and a magnificent wooden propellor attached to its nose.

The Bell personnel could usually be distinguished by the black derbies they often wore. Although the air space around Muroc was restricted, P—38 pilots from a nearby field would at times invade the restricted area to see what was being tested. On one XP-59 flight, as one of the P-38's approached, Jack Woolams, the Bell pilot pulled a gorilla mask over his face, stuck a big cigar in his mouth, and wearing the black derby, pulled alongside the P-38. That night the local bar heard the unbelievable story of a propellorless plane, flown by a cigar-smoking gorilla wearing a derby. That may have been the forerunner of the flying saucer stories a decade later.

Testing at Muroc ended in March, 1943. Six aircraft had been involved. Additional flight tests were conducted from the Bell factory at Niagra Falls Airport during the next several years.

By the end of October, 1942, Harland Poyer, the Bell project engineer, had become the first jet passenger. A hole was cut between the nose of the airplane and the pilot's compartment where the machine guns were to be mounted. This was fitted with a seat and a wind-screen, scarcely luxurious acomodations. Two years later, another XP-59 was modified at Bell to permit an Air Corps general to have a ride. Unfortunately, he became airsick during his first flight; it is not recorded whether the air was particularly rough or whether the pilot assisted the process by some appropriate maneuvers.

(continued on page 15)

The heraldry of the air . . .

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SHOWN ACTUAL SIZE

Here are the famous airlines of today—*British Airways*, *Air France* and *KLM*, oldest airline in the world still operating under its original name . . . *Pan Am*, first airline to provide transatlantic service . . . *Swissair*, *Sabena* and *Alitalia* . . . *Qantas*, the Australian airline that is one of the world's oldest . . . *Olympic*, Greece's only airline . . . and *Iberia*, the national airline of Spain.

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response

Nuance welcomes your response and makes an effort to print each letter. Please address all letters and inquiries to Editor, **Nuance**, Inglewood, CA 90306.

The Response column is hardly the place for a technical dissertation on Flight 191, but I cannot let Mr. Daugherty's article (Cumulative Causes of Aircraft Disasters - Fall '80) on that event get by without comment.

A great amont of time, effort and far too much publicity has been devoted to the broken bolt and the loss of an engine. Little or no publicity has been given to the reason for the retracted leading edge slats on the left wing, which created the stall condition and led directly to the crash. Had the leading edge slats maintained their position despite the rupture of their control system, there would have been no stall and, most probably, no crash. The DC-10 is quite capable of flying on two engines, as has been well demonstrated.

Typical of the countless articles written about this unfortunate event, Mr. Daugherty's article gives much attention to the loss of the engine and the most probable causes but speaks not at all to the collapsed leading edge slat system which, in truth, contributed most to the crash. A more adequate stall warning system is fine if it stays operational under damage conditions and if the pilot can safely nose down without ploughing into a mountain or high-rise building. Preventing leading edge slat system collapse through good design seems a much better approach.

I would suggest that Northrop U. students concerned with safety design look at several leading edge slat systems and make note of their stability under damage conditions such as experienced on Flight 191.

Sincerely,

William S. Battis
Alsea, OR
(LCC Safety Assurance, Retired)

I would appreciate it if you would send me 10 additional copies of the Winter '81 issue of **Nuance**. This was an excellent issue.

Sincerely,

Richard W. Millar
Vice Chairman
of the Board
Northrop Corporation

Reprint Request

I have the Winter '81 issue of your magazine sent to our director of public relations. Several of us in public relations at Alcoa found the article on nuclear power (Nuclear Reaction-Winter '81) to be very interesting and well-done. And we would like to reprint it for distribution to our employees.

Many Thanks.

Sincerely,
Elinore S. Thomas
Coordinator
Corporate Information
Alcoa

In Memory of An Alum

Enclosed please find a check for $25.00. I'm sending it to you in memory of my husband, Richard G. Stierley, class of '67, B.S. Engineering I would like the check applied to the College of Engineering. Richard passed away April, 1981, of cancer.

Richard always spoke highly of Northrop University and he thought you have the best curriculum.

I would very much like to keep receiving **Nuance** so I know what is going on at Northrop University. When it is time for my son Greg to go to college, I'm hoping he comes to Northrop University.

Sincerely,

Sharon M. Stierley

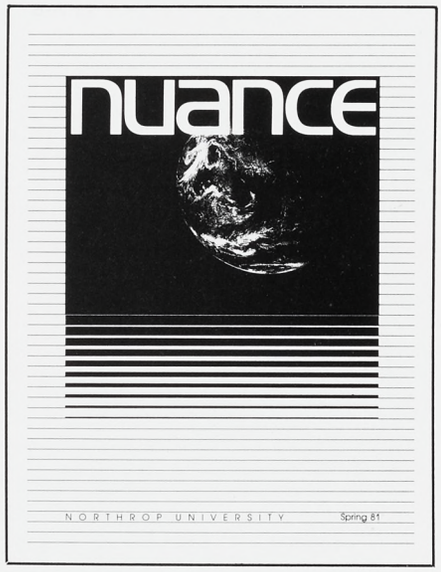
Alum From Brazil

I have responded to the reader survey form and I was surprised to see that it has reached its destination (Spring '81 issue).

In spite of the time-consuming position I hold with VARIG Brazilian Airlines, when **Nuance** is placed on my desk, coffee-time starts.

Very truly yours,

E.W. Soboya
Chief Engineer
Flight Operations
VARIG Brazilian Airlines



Remembering David Hatfield

Just received the Spring '81 **Nuance**, a most attractive journal. Needless to say, I was delighted to find this continuing coverage of the saga of the Northrop Flying Wings. But, that was quickly tempered when I turned to page 10 to discover that David Hatfield had passed away.

It was my pleasure to have met him on several occasions in the late 70's during visits to L.A. Just wish there'd been the opportunity for that "one more" time.

Sincerely,

M. Rosen
San Francisco, CA

Jet Propulsion

Continued from page 7

LATER ENGINE DEVELOPMENTS

During 1943, a few I-14 engines (1,400 lbs. thrust) were produced and used to power later flights of the XP-59A. A 2,000 lbs. thrust version was designed, but never built. During 1943 and 1944, 241 I-16 (1,650 lbs. thrust) engines were produced by G.E.

The I-16 was 41 inches in diameter and 72 inches long, with all accessories. Its dry weight was 857 pounds. The #3 engine can be found in the shops of the Institute of Technology at Northrop University. It was run up about two years ago, but concern regarding a starter gear restricted operations. Last month it was started again and ran beautifully.

The original historical records of this #3 engine show that it was received at Bell Aircraft on March 23, 1944, just a few weeks before I joined Bell as a flight test engineer. It was installed in the P-59-A1-BE a number of months later. This was the jet on which I ran a series of tests to determine why aircraft and engine performance was lower than anticipated. So, Northrop University has reunited me with an old friend - or more accurately- with an old problem.

Development of a larger engine of the same centrifugal type design, the I-40 with 4,000 lbs. of thrust, began at G.E. in June, 1943. It was first tested in January, 1944, and first flown in a Lockheed XP-80 in June of that year. Three hundred of these engines, eventually designated the J-33, were produced by G.E. and thousands more by Allison beginning in 1945.

THE NEW BREED OF AIRCRAFT

The I-16 was used by the YP-59A, of which 13 were built, the P-59A (20 produced), and the P-59B (30 produced). These were assigned to the 412th Fighter Group, initially based at Muroc and later at Santa Maria, California.

In 1943, Lockheed Aircraft designed a single engine fighter using the I-40/J-33 engine. The proposal was submitted on June 15, and on June 17 a letter contract was issued; one airplane was to be delivered in 180 days at a cost of $495,210.

The first flight of the XP-80 took place in January, 1944, using a Halford H-1B engine producing 2,240 lbs. thrust. In June, the XP-80A, called the Shooting Star flew with an I-40/J-33 engine.

During 1943-45, Bell Aircraft developed a single seat fighter, the XP-82, using two I-40's. Wingspan was 35 feet, length 45 feet, and height 15 feet. Two aircraft were built, one of which crashed near Niagra Falls.

The TG180/J-35 engines were used in numerous aircraft and axial flow engines soon replaced the centrifugal type. Aircraft included the original Republic XP-84 Thunderjet, Northrop's F-89 twin engine interceptor, the Consolidated Vultee XB-46 four engine medium bomber, the first Boeing XB-47 medium bombers (six engines), the Northrop XB-49 Flying Wing (eight engines), the Douglas D-558 Skystreak, and the Hughes crane helicopter, XH-17.

THE ANNIVERSARY

Forty years after those first meetings in Washington that introduced the jet propulsion concept to the United States, jet aircraft-military, commercial, and private-fill the airways. Engine thrusts of 1,250 lbs. have increased to 55,000 lbs. and more. The initial jet engines could only fly 5 hours between inspection or overhaul; now jet aircraft can fly 11,000 hours before an engine overhaul. Speeds, initially 350 m.p.h. maximum, are now measured in Mach numbers of 2, 3, 6, and above.

The first jets are now history; today's are the promise of an even more exciting future.

The Lockheed YP-80A Shooting Star

Materials from General Electric, Bell Aerospace Textron, Lockheed-California Company, and from an article by Ronald D. Neal in the American Aviation Historical Society Journal (Fall, 1966) are gratefully acknowledged.

Everett T. Welmers, Dean of the College of Engineering at Northrop University, received his Ph.D. in mathematics with a minor in astronomy from the University of Michigan. He has lectured at the University of Buffalo in pure and applied mathematics, as well as participating in special study projects with the Institute for Defense Analyses. He was also Assistant to the President at Bell Aircraft Corporation and later Assistant to the President at the Aerospace Corporation.

1.

focus

Computers In The Cockpit

by Philip Struyk

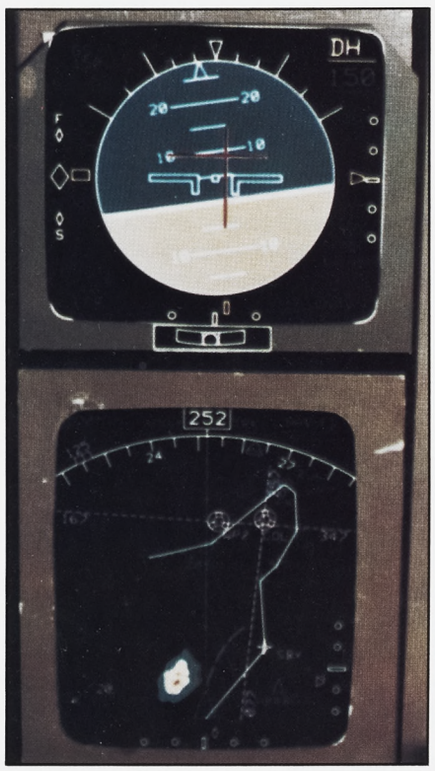
True aviators will always prize the challenge of cross-country flight in a light airplane using the compass and a chart to navigate. Mastering the skills necessary to navigate with a minimum of aids will continue to be the thrilling part of a pilot's education. However, in today's complex world of commercial air transport, where the airliner has all the comfort of a flying hotel, the aircraft depends upon the computer to integrate its flight systems, provide high reliability, cut maintenance costs, and fuel consumption, and simplify the crew's workload. In the new generation aircraft, flight crews will have the freedom to concentrate on the safety, smoothness, and efficiency of flight.

Computers do not think with more intelligence than a pilot; however, they perform certain thought processes many times faster, with fewer mistakes and without need of a rest period. Today, the digital computer uses a high speed electronic pulse, measured in nano seconds and microseconds causing instantaneous feedback. In the world of high performance aircraft, this instantaneous response is a necessity. Because of the microcircuitry techniques, multiple functions can be included in a single computer. This allows for redundancy in a system and increases its reliability. The very nature of digital computers and electronic systems facilitates self-monitoring and testing so that fault tracing can be done during flight.

Aircraft manufacturers have redesigned the cockpits to accommodate the digital flight management systems. The new flight deck layout is a simplified cleaner area, with fewer distracting instruments. The quiet, dark cockpit of Boeing's 767 and 757 have a few green or blue lights which signify normal system operation. The flight deck layout is now reserved for video screens pertinent to immediate action and warning systems.

The successful use of video display screens aboard military jet fighters has inspired the commercial airlines to adopt them. The Electronic Flight Instrument System will project flight and aircraft system information on video screens located on the instrument panel. Computerized symbol generators create color images on the video screens of the Attitude Director Indicator and the Horizontal Situation Indicator which have a

(1) The flight deck of the Boeing 767/757 simulator with the video flight instruments for the captain and first officer, and the video engine instruments on the center panel. (2) The Boeing 767/757 flight deck will include the electronic flight indicating system version of the Attitude Director Indicator (ADI) above, and the Horizontal Situation Indicator (HSI) below. (3) Conventional flight deck instrumentation of the McDonnell Douglas DC-10.



2.

3.

"Have you ever thought, not only about the airplane, but about whatever man builds, that all of man's industrial efforts, all his computations and calculations, all the nights spent over working drafts and blueprints, invariably culminate in the production whose sole and guiding principle is the principle of simplicity?"

-Antoine de Saint Exupery

similar appearance to the presently used electromechanical versions of these instruments. Superimposed on the basic Horizontal Situation Indicator, are the mapping and weather indicators. The pilot will be informed where he is, where he will go if he retains his present course, and where he should go according to the flight plan and all with reference to weather avoidance information. The Electronic Flight Instruments will greatly lessen the work load of the pilot, freeing him to concentrate on the safety of the flight.

Airlines expect a tremendous improvement in all around aircraft performance with the introduction of digital flight deck systems. They expect to cut maintenance costs by three quarters through in-flight fault testing and to reduce fuel consumption by the digital system's lighter weight and ability to direct precise flight performance. Digital systems have an ability to handle numbers of any length and therefore have few precision limitations. They also have no moving parts and require very little maintenance.

In the integrated flight management systems of the digital computer, five main computer subsystems work together to monitor and control the pressures, temperatures, thrust, climb, cruise and descent procedures in relation to the best fuel economy. For the first time, the Boeing Aircraft Company will integrate five computer subsystems-Flight Management Computer, Flight Control Computer, Thrust Management Computer, Electronic Flight Instruments and the Caution Warning System into one arrangement of highly sensitive instrumentation.

The concept of computerized flight isn't new in the air transport industry. The development of the airborne applications of the computer has required years of testing and retesting. The aircraft computer-controlled systems evolved through the Douglas DC-6 and DC-7, the Lockheed Constellation and the first generation of jet airlines, the Boeing 707, Douglas DC-8 and the Convair 880 and 990. However, these early analog based computerized systems were heavy, large, slow and required high amounts of electrical power to operate. By using the simple, coded pulses of the digital techique rather than the complex analog signal, the individual processing functions of the computers were simplified, allowing for more of a variety of

inputs in a more responsive, automated flight system.

The flight management system of the Boeing 757/767 stores flight plans, indicates flight progress, issues control commands, monitors aircraft performance and systems and optimizes inflight fuel consumption. The pilot who uses the digital flight management system will have a stronger control over the economy of the flight, enlarging his function to include that of a fiscal manager. Pilots of today's super aircraft don't only compete for lowest enroute time, but for lowest fuel consumption between stations.

Better Safety Measures

Improving the computerized flight system further improves the safety of the flight. Another example of this is the development of the Engine Indication and Crew Alerting System (EICAS) on the new 757/767. This system will also make use of the video display located on the center instrument panel easily visible to both pilots. Crew Alerting System provides both aural and visual cautions and warning of conditions within the aircraft engines and systems. Over 400 inputs from the engines and selected subsystems are monitored by the Crew Alerting System. Any abnormal condition will be classified as a warning, critical caution, or advisory caution by the EICAS display. It identifies the problem area, its degree of urgency, and the recommended corrective action. Any in-flight emergency can be dealt with more easily with this system.

The object of the redesigned Boeing system is to reduce the manipulative functions of the flight crew, thus reducing fatigue and increasing safety. To that end, pencils and charts have given way to the Control Display Unit (CDU) which serves the flight crew as data input into the flight management computer. The Captain and First Officer each have a video display unit located on the center of the console of the flight deck which is the entry point via an alpha-numeric keyboard for flight information. The video display shows the range and bearing information, holding patterns at a designated fix, departure and arrival procedures for airports in the route structure of the particular airline, and many other items. Routine cockpit chores are simplified, eliminating cumbersome paper handling.

Computer-Aided Maintenance

The overall safety record for aircraft maintenance in the airline industry has been outstanding. To insure this excellent record is maintained, the Boeing people have refined computer-aided aircraft maintenance systems of the 757/767. The built-in-test-equipment system (BITE) provides inflight fault isolation and functional test capabilities through the Maintenance Control and Display Panel computer which has a non-volatile (power-off) storage memory. The Maintenance Control and Display Panel are able to store a record of up to 35 faults from each of 10 previous flights facilitating the analysis of recurring fault patterns. Ground maintenance crews will be better able to perform their duties in assuring the safety of airline travel.

The flight management system of the 757/767 was designed with the anticipation that improvements and innovations, now only in the developmental stages, will be incorporated into the system. One example of such system is the TNAV or four dimensional navigation system which automatically controls the airplane relative to its flight plan and the flight plan of other aircraft. TNAV will be linked to the Air Traffic Control Network, and, with the aid of the computer, the system will maintain precise control over enroute check-point arrival times and runway threshold arrival times. Air traffic controllers will be able to more safely handle a higher volume of traffic during peak traffic hours.

Not only Boeing, but McDonnell Douglas is using the computer to improve flight deck duties. The fully

Analog and Digital Briefly Explained

An analog signal processed in an electronic circuit is an alternating current (AC) or direct current (DC) that varies in either a consistant or random manner. The analog signal is continuous and does not change abruptly or in increments. The temperatures, pressures, movements, and other parameters sensed by the aircraft systems are fed into an analog network where they are processed. The analog signal is then either computed for control feedback or used for monitoring. Sometimes the analog signal is changed into digial signals to be used by a digital system.

The digital signal processed in an electronic circuit is a series of rapidly changing voltage levels called pulses. These pulses occur in steps or increments and essentially are voltage values switched between two fixed voltage levels. The two-level switching of the digital or logic circuit lends itself to a coded language that can be processed at high speeds. The digital computer can read an incoming coded signal, process it, and send it out for feedback control or monitoring. Aircraft today are generally a combination (hybrid) of analog and digital.

operational DC-9 Super 80 is the first commercial airliner to feature the head-up display (HUD). The head-up display system is an optical unit that essentially provides guidance through visual symbols while the aircraft is on approach for landing or during take-off. The pilot looks through a viewer held in position 6 inches in front of his eyes as the unit displays computer generated guidance cues, and combines them with the pilot's view out the windshield. The HUD system lessens the pilot activity on an instrument approach, increasing the probability for the pilot to choose to land the aircraft when it reaches decision height (if conditions permit) rather than execute a missed approach and go-around. Flight crews are able to fly the instrument landing systems with more confidence and safety with this new system.

Increased Fuel Efficiency

Not only is safety a reason for the development of computers in flight management systems but also fuel efficiency as well. By the end of the decade fuel could represent 60% of the direct operational cost. Increased fuel costs have prompted airlines to install fuel-saving devices on their existing fleet of jet airliners. An example of one of these systems is the Performance Management System currently being installed on the Boeing 727-200 airplanes. This computerized system uses approximately 15 different engine, temperature, pressure, airspeed, and navigational inputs to place the engine throttles in their most efficient power setting. Another use of the computer in fuel savings is on the Lockheed L-1011 jet liner. To save fuel, Lockheed has extended the wingspan of the L-1011 by nine feet (4 1/2 feet on each wing tip). The resulting increase in the wing aspect ratio (the ratio of the length of the wing to the width of the wing) has reduced aerodynamic drag allowing for greater fuel efficiency. To preclude a major wing redesign, computer aided "active controls" were developed to relieve the internal wing stresses that would otherwise result from adverse forces on the extended wing. Fuel efficiency will continue to motivate computerized innovations as the price of fuel continues to climb.

The computer has been used in airline scheduling for years, which has resulted in greater efficiency in aircraft use. One computerized, fully automated system being installed on current airliners is the ARINC Communications Address and Reporting System (ACARS). ACARS is used to transmit airline operations data between aircraft and ground personnel. The system automatically transmits terminal departure time (out), wheels off time (off), touchdown time (on), and terminal arrival time (in). Besides out/off/on/in reports ACARS electively transmits engine data reports, position reports, telephone patch requests, miscellaneous coded messages and more.

Air carrier and general aviation aircraft industries developed the flight management systems from military-initiated research and development, reaping information from declassified components and systems and adding their own refinements. The present technology of Very High Speed Integrated Circuits (VHSIC) being developed for weapon systems will someday find its way into commercial and general aviation.[4]

Computerized flight systems have reduced flight crew workload and increased operation's economy making air travel safer and more efficient. Future systems which are computer operated will further increase safety and efficiency factors. This is good news as our dependence on air transportation increases in the decades ahead. nu

The roll-out ceremony of the new Boeing 767 in Everett, Washington this year.

Philip H. Struyk is Chairman of the Electricity and Electronics Department of the Institute of Technology at Northrop University. A faculty member of the Institute of Technology since 1973, Mr. Struyk has taught Aircraft Electrical Systems for 4 years and is currently involved in an expanded Electronics Technician program that includes Avionics Technology and Numerical Control Electronics Technology.

alumni

AN OPEN LETTER TO ALUMNI AND FRIENDS OF NORTHROP UNIVERSITY FROM THE PRESIDENT OF THE ALUMNI ASSOCIATION

Dear Northrop University Alum,

Each year the University takes to the streets of distant and local communities to spread the word about the educational and career-related opportunities for students on campus. During the school year our recruiters are very busy covering a wide variety of events at local high schools, community colleges, and other institutions. Naturally, the monumental task of carrying the Northrop University banner throughout California, much less throughout the U.S. or the world, can present some problems.

In my role ar Alumni President, I have been adamant in my support of an effective domestic recruiting program and have received much support from all University members in this regard. Dr. Shell, the Student Government, and each recruiter have assured me that everything in their power has been done to accomplish this objective, and I have witnessed the commitment. However, there is only so much that can be accomplished by this group of professionals.

Therefore, I am calling on **YOU**, the extended family of the University, to become involved in this task. There are many ways in which **YOU** can assist us in spreading the word.

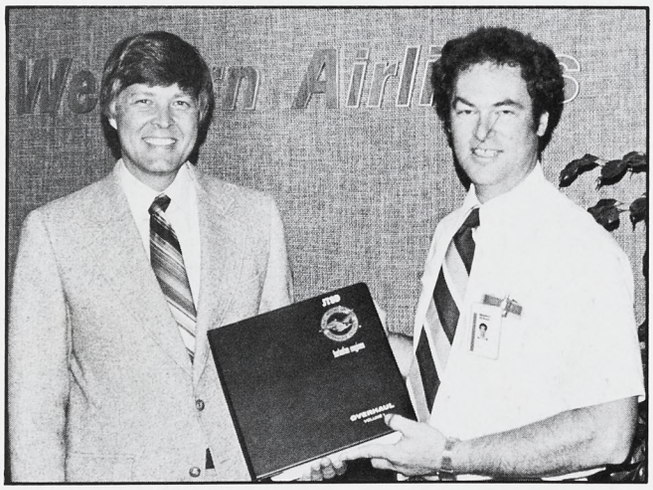
1. **YOU** are the role model for what can be accomplished with an education from Northrop University. **YOUR** participation in recruiting events can bolster the efforts of our recruiting staff and enable them to cover more completely these events.

Whether you elect to accompany our recruiters to the high school or college (junior) which you attended, or to personally approach your local schools as a local contact for Northrop University, **YOUR** contributions can be extremely valuable.

2. You can contact with local educators in your community who can make students aware of the presence of Northrop University.
3. You can register with the Career Center (Alumni Office) as a recruiter and they will advise you of "career and college days/nites" in your area which you can attend to represent the University.
4. You can take part in the "Recruitment Committee" of the Alumni Association to help us plan and accomplish new ideas.

Taking part in these and other activities will refresh the good feelings and memories you have of your alma mater and will benefit those whom you contact. The Alumni Association is committed to helping N.U. reach out to those students who need the type of education which is available here. Please join us in this worthwhile endeavor. We look forward to welcoming you to our growing circle of business associates working for our alma mater.

Sincerely,
Raul Alvarado, Jr.



Alumni are an excellent source of equipment and textbooks. Ed Salzer (right), a graduate in Aircraft Maintenance Engineering in 1967, made it possible for Northrop University to receive a very valuable set of JT8B engine overhual manuals from Western Airlines.

Note: Information regarding the Fall 1981 recruiting schedule, or other recruiting materials and programs should be directed to the Alumni office, Northrop University, Inglewood, CA 90306. (213) 641-3470, ext. 232 or 227.

ALUMNI LAURELS

On May 17, 1981 **Mr. Robert Thomas Hultz** received his Master of Business Administration from Stetson University, Deland, Florida. Mr. Hultz is an Alumnus of Northrop University, BASE, 1969. Congratulations!

On June 13, 1981 **Mr. Jaaber Badavi** was awarded a Master of Science degree in Engineering from the California State Polytechnic University, Pomona. Mr. Badavi is an Alumnus of Northrop University, BSME, 1978. Congratulations!

G. Boyd Sellers, a graduate of Northrop University's School of Engineering in 1955, has been appointed "Director of Sales" for Voi-Shan of Culver City, California, division of VSI Corporation.

After attending the UCLA Graduate School of Business and Management, Boyd joined the Voi-Shan team in 1962 as a Sales Engineer covering the company's eastern and midwest territories as well as Canada.

Northrop University's Alumni Association is proud to hear of the accomplishments of its members. Write in to your Alumni Association and let us know about your career's progress.

LOCKHEED CALLS FOR NORTHROP U. ALUMNI

The College Relations and professional employment people want all you Northrop University grads to know about some good jobs available at Lockheed-California Company. Experienced persons can obtain information on the following jobs by contacting the Career Center at Northrop University.

Some of the jobs which are currently unvilled are in:

AIRCRAFT DESIGN
- Airframe Design
- Environmental Control System
- Flight Controls
- Electromechanical
- Hydraulics
- Primary Electrical
- Radome and Windshield
- Equipment Installation specialists

AVIONICS SYSTEMS
- Acoustics
- Radar Software test
- Radar and ESM Design
- Display and Control specialist

Details and requirements are on file with the Career Center. (213) 641-3470, ext. 232.

ALUMNI

WHERE IN THE WORLD ARE YOU?

The recent Alumni Directory points out the widespread employment of Northrop University Alumni. We have listed below many of the companies and corporations who employ our grads and many of the airlines which indicate the worldwide nature of the Northrop University alumni. These listings were developed from the Directory survey of 1980, and are ever-changing.

COMPANY	# ALUMNI EMPLOYED
Self Employed/ Owners/ Presidents of Businesses	500+
Rockwell International	288
Northrop Corp.	157
Hughes Aircraft Co.	155
Lockheed Corp.	155
McDonnell Douglas Corp.	155
Garrett Corp.	86
Boeing Company	85
Continental Airlines	77
United Airlines	70
Trans World Airlines	69
Western Airlines	68
American Airlines	61
United Technologies Corp.	50
General Electric Co.	44
General Dynamics Corp.	42
U.S. Air Force	41
Northrop University	41
Martin Marrieta Corp.	37
Eastern Airlines	35
Federal Aviation Administration	33
Flying Tiger Airline	30
Republic Airlines	28
U.S. Army	25
Pan American Airways	22
NASA	21
U.S. Navy	21
Naval Weapons Ctr.	21
I.B.M. Corp.	20
Cessna Aircraft	20
Grumman Corp.	19
Pacific Southern Airways	18
Ford Motor Company	18
Rohr Corp.	17
Delta Airlines	17
Aerospace Corp.	16
Sperry Flight Systems	16
Sperry Flight Systems	16
Westinghouse	15
Beech Aircraft	14
Aerojet Industries	14
Honeywell Inc.	13
Northwest Airlines	13
Ford Aeronutronic	12
Goodyear Corp.	12
Texas International Airlines	12
U.S. Post Office	12
Control Data Corp.	11
Hewlett-Packard Co.	11
Litton Industries	11
Piper Aircraft	11
Teledyne, Inc.	11
University of California	11
Xerox Corp.	11
Fluor Corp.	10
Frontier Airlines	10
Jet Propulsion Laboratories	10
Piedmont, PSA, Royale, Saudi Arabian, Swift, Trans-America, U.S. Air, Air Alaska, Wolf, World, Air California, Air Canada, Air Wisconsin, Alaska, Braniff, Chatauqua, Federal Express, Freedom, Golden Gate, Golden West, Hawaiian, Japan, Middle East, Mountain West, Northwest Orient, and other Airlines	96

Unfortunately we do not have accurate employment information for ALL of our alumni; these are only a few of our representatives in the business world. If you are aware of other N.U. grads who are not included in this count, have them contact the Alumni Office at Northrop University so that next year we can give you an updated listing of where you all are.

You can see from this list that the contributions of your fellow alumni are continuing to make the world a better place in which to live.

WE OF YOUR ALUMNI ASSOCIATION SALUTE YOU.

SHARE THE DREAM

Northrop University has produced a high quality, full-color reproduction of "The Spirit of John K. Northrop". The original oil painting by the internationally famous artist, Douglas Ettridge, was specially commissioned by the University in 1978.

Each 17x 21½" print (16x20" image area) is reproduced on fine textured lithographic paper and is suitable for framing.

This is a collectible art piece to treasure for years or send to others as a gift so they may also share the the dream.

$19.50 each

Please send me _____ prints at $19.50 each. (add $1 for postage and handling) California residents add 6% sales tax.

Name _____

Address _____

_____

City, State, Zip _____

_____

☐ My check or money order is enclosed payable to:

Northrop University

(Please allow 3 weeks delivery)

Mail to: Northrop University
Campus Store
Inglewood, CA 90306
att: Jack Behne

FUTURE FOCUS: PHOTO CONTEST

Nuance is announcing the "First Annual Photography Contest" with the theme "**Future Focus**".

All **Nuance** readers are encouraged to participate. The grand prize winner will capture a unique angle of vision describing a futuristic landscape, people or mood. All photographic techniques from multiple exposures to time-lapse, and microphotography are welcome. The winners will demonstrate a high degree of excellence in composition, creativity and handling of technique.

The winning submissions will be published in future issues of **Nuance**. Separate competitions will be held for color and black and white photography. Within each competititon, first, second, third place entries will be chosen, as well as up to three photos for honorable mention. The grand prize winner will be featured as a **Nuance** cover. All competition winners will be published in an upcoming issue of **Nuance** and receive a certifcate of award from Northrop University.

Rules of the game:

1. Must be previously unpublished photos or slides.
2. Enter as many slides or photographs as you wish.
3. Send 8x10 prints or 35mm slides.
4. Each entry must be identified by attaching your name, address, and phone number to the back of the print or the edge of the slide.
5. Prints and slides become the property of **Nuance** and will not be returned.
6. **Nuance** retains all reproduction rights on the photographs and slides submitted.
7. Entries must be postmarked no later than April 15, 1982 and sent to: Editor, **Nuance**, Inglewood, CA 90306.
8. Winners will be announced by the Summer 1982 issue.

ENTRY

FUTURE FOCUS

NAME _____

ADDRESS _____

_____

PHONE ( ) _____ DATE _____

CATEGORY B&W COLOR

FOR ALUMNI:

DEGREE _____ YR. OF GRAD. _____

Please use this entry form (or copy) as the attachment to your entry and mail to: Editor, **Nuance,** Northrop University, Inglewood, CA 90306

CAMPUS OFFERS HOUSING TO ALUMNI VISITORS TO L.A.

As an alumnus of Northrop University you can now save money by visiting the campus. The Alumni Association has arranged for nightly and weekly rates for housing at the dormitory. These rates are below comparable hotel/motel rates by as much as 50-70%, and can include meals for budget conscious individuals as well. Ideal for travelers who want to freshen up between flights, or for extended visits, the dormitory is located within minutes of LAX, and operates 24 hours per day, seven days a week.

This arrangement will provide reasonably priced accomodations for visiting alumni in a central location. Several other suites on the upper floors may be leased to local corporations for their housing needs, and a wide variety of services are being contemplated to support this use. Maid service, airport pick-up and delivery, laundry facilities, and the availability of University facilities can make this a convenient place to stop.

For complete details and reservations, contact the Alumni Office at (213) 641-3470, extensions 227, 232, 327, between the hours of 9 a.m. and 5 p.m., Monday through Friday.

DONATIONS TO THE LAW LIBRARY

The family of Mr. Elmer P. Bromley, Esq., California's oldest living legislator, has dedicated a 2,000 volume collection of law books to Northrop University's Law Library. They are also contributing the glass shelves and office furniture to complete several Bromley Group Study Rooms within the Library.

The law firm of Tyre and Kamins in Century City presented several collections of books and journals.

Mr. Stanley Pearson, Esq., of Burbank donated a set of Corpus Juris.

President Shell welcomes Chairman of Industry Advisory Board. Bob Rogoff, from Rockwell International, is the new Chairman of the Industry Advisory Committee for the College of Engineering Technology.

The law firm of Reifman and Altman in Beverly Hills donated volumes on tax regulations, internal revenue codes and acts, and legislative material.

Mr. Louis Brown, Esq., a member of the Board of Trustees, donated a collection of his law books.

Mrs. Henry C. Johnson donated original editions of Bouvier's Law Dictionary and the Cyclopedic Law Dictionary, and Mrs. Charles C. Greer donated law books from her private collection.

With these editions, the Law Library now has over 30,000 volumes.

NATIONAL DELTA THETA PHI LAW FRATERNITY CONVENTION

Northrop University School of Law has a chapter of the Delta Theta Phi Law Fraternity on campus. During August 12 through 15, in St. Louis Mo., the 42nd Biennial Delta Theta Phi convention was held. Northrop University was represented.

In 1981, the Delta Theta Phi Law Fraternity consists of a total membership of approximately 70,000 which includes 87 active student senates and 101 alumni senates.

The Northrop University Senate was started in 1980.

Carl Pentis, President of the Pierson M. Hall Senate, was one of 500 delegates at the convention and represented Northrop University.

His speech to the convention served as a brief introduction of Northrop University to the law community.

The convention was attended by equal numbers of students and alumni. Among the alumni were numerous judges (Federal District and State levels) as well as district attorneys. The information passed on by all delegates as to their professional experiences was of great benefit for the students and attorneys alike.

THE PIERSON M. HALL SENATE

An Introduction
by Carl Pentis

Presented to the National Delta Theta Phi Law Fraternity Convention

The name "Northrop University" must immediately bring to mind the concept of aviation and John K. Northrop. The name of our Senate was likewise chosen with aviation in mind. Pierson M. Hall has been known as the expert on Aviation Law and was the deciding judge on the famous DC-10 crash "peris" case.

Earlier this year, the Hall Senate of Northrop University further cemented its ties to aviation with the granting of an honorary membership into Delta Theta Phi to Dr. Knut Hagrup, Laureate Professor of Northrop University. Dr. Hagrup has been President of Scandinavian Airlines, President of International Air Transport Association, Chairman of European Air Transport Association and Chairman of Commission of Air Transport at the International Chamber of Commerce.

The Hall Senate of Northrop University distinguished itself at the outset by having every member of the Editorial Board of the Northrop University Law Review being a member of Delta Theta Phi. The Law Review is likewise tied to aviation as its title is "Northrop University Law Journal of Aerospace, Energy and the Environment."

The Pierson M. Hall Senate of Northrop University is rapidly expanding and will certainly be an asset to Delta Theta Phi Law Fraternity.

PROGRAMMING FOR THE HANDICAPPED

In what has been officially designated as the International Year of the Handicapped, Northrop University is doing its share. The University is providing the site for a highly innovative pilot project for training handicapped students for careers in computer programming.

The special twelve-month project has brought 32 handicapped students to campus. Using eight computer terminals which feed directly into an IBM 3033 mainframe computer at Northrop Corporation, the students learn advanced COBOL programming language in preparation for guaranteed jobs in industry which will offer salaries from $15,000 to $18,000 for starting positions.

Among the disabled students are persons totally deaf, partially blind, and others confined to wheelchairs. For six of them, a special suite of rooms in McKinley Residence Hall has been arranged.

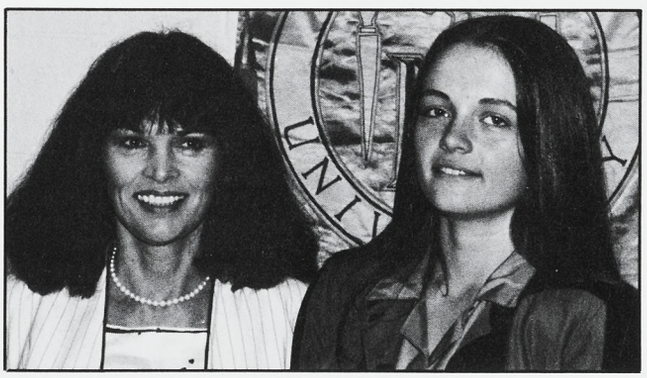
The computer program was organized by a local non-profit organization, Westside Community for Independent Living, and is funded this year by the California State Department of Rehabilitation. Their mutual goal is to provide the handicapped with the opportunity to lead independent, self-sufficient lives through highly technical training. "It's a new project," says WCIL Director Bob Taylor, "to train the handicapped to compete for the high paying technical jobs. But it will be a success. We have the support of more than fifteen major national corporations and banks."

The computer programming project provides an excellent model for cooperation between the private and public sectors to advance the career opportunities for the disabled.

Northrop University affirms its commitment to equality of opportunity for all individuals. This commitment requires that no discrimination shall occur in any program, activity or employment of the University on the basis of race, color, religion, sex, national origin, age, handicap, or any other classification that precludes a person from considerations as an individual. This policy assures compliance to Title IX of the Educational Amendments of 1972, as amended, sections 503 and 504 of the Rehabilitation Act of 1973, Title VI and VII, of the Civil Rights Act of 1964, and other related executive orders and administrative regulations.

Questions concerning the application of non-discrimination laws at Northrop University may be referred to the campus Mediator who is assigned the administrative responsibility of reviewing such matters-John Wietting, Dean of Student Services, Northrop University, Inglewood, CA 90306, (213) 641-3470 or to the Regional Director of the Office of Civil Rights, Region 9, 760 Market Street, Room 700, San Francisco, CA 94102.

If any student or employee feels he or she has been discriminated by way of institutionally related matters of education and employment, and wishes to file a complaint, the school has provided grievance procedures which are available to the complainant at the Office of the Mediator, 5800 West Arbor Vitae Street, Los Angeles, California 90045.



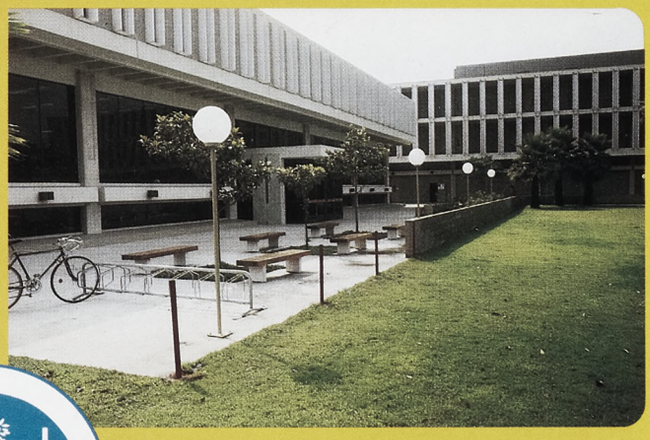
At 17 years old, Laurie Groman (on right) is the youngest student ever to graduate from the Institute of Technology with an Aviation Technician's Certificate. Laurie's mother, Joanne Alford, is a charter member of the Experimental Aircraft Association, the first woman to build and fly her own aircraft, and the first woman to join the Professional Racing Pilots' Association.

COMING UP

The Winter issue of **Nuance** will be a special International Issue featuring:

- The special JPL color photos of the rings of Saturn
- An alumnus who rebuilt a P-51B World War II bomber
- A lawyer who travels from New York to Northrop University to teach corporate law
- Special coverage of International Week at Northrop University

An Invitation to Support Northrop University



1942 *1981*

- Within 39 years, Northrop University has grown from an aviation technician school into a significant learning center of over 1,800 students including Colleges of Technology, Engineering, Business and Management, a School of Law, and a Language Institute.
- You will help Northrop University grow with your gifts. The ways you can choose to give are many and are all tax-deductible.

Checks are the most direct way of mailing in your contribution.

Securities which have appreciated in value have a double tax advantage. They are deductible at their current market value and all capital gains tax is avoided in a transfer to Northrop University.

Real Estate, **Life Insurance**, and **Equipment** are also excellent ways of contributing to the future of Northrop University.

Pledges are perhaps one of the most popular forms of making capital gifts. They help us plan and when payments are made they become tax deductible for that year.

Give A Gift & Grow

With Northrop University

- Indicate your form of support and your preferred fund on the attached card. Enclose it in the provided postage-paid envelope with your contribution and mail it today!

Should you wish to arrange special gifts or memorial designations, please call the Office of the President at (213) 641-3470 or 776-3410, ext. 284.

Give A Gift And Grow

I pledge my support to the future of **Northrop University** with this tax-deductible contribution

$ _____

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Class _____

Address _____

_____ **Zip** _____

Telephone ( ) _____

Please apply the enclosed check or money order to :

- ☐ **Alumni Fund**
- ☐ **Alumni Library Fund**
- ☐ **School of Law**
- ☐ **College of Engineering**
- ☐ **College of Business**
- ☐ **Aviation Technician School**
- ☐ **Endowment Fund**
- ☐ **Nuance Research Fund**
- ☐ **University Operations**
- ☐ **Other** _____

☐ Yes, I pledge to give $_____ or _____ (specify gift) to **Northrop University** as a contribution to the long-term growth of the school.

☐ Please contact me. I would like more information about how I can contribute to the growth of **Northrop University.**

Your **University** depends on your **Generosity**

Northrop University will grow faster if you give. You can make the difference!

Attn: Office of the President

Give a Gift & Grow
Northrop University
Inglewood, California 90306

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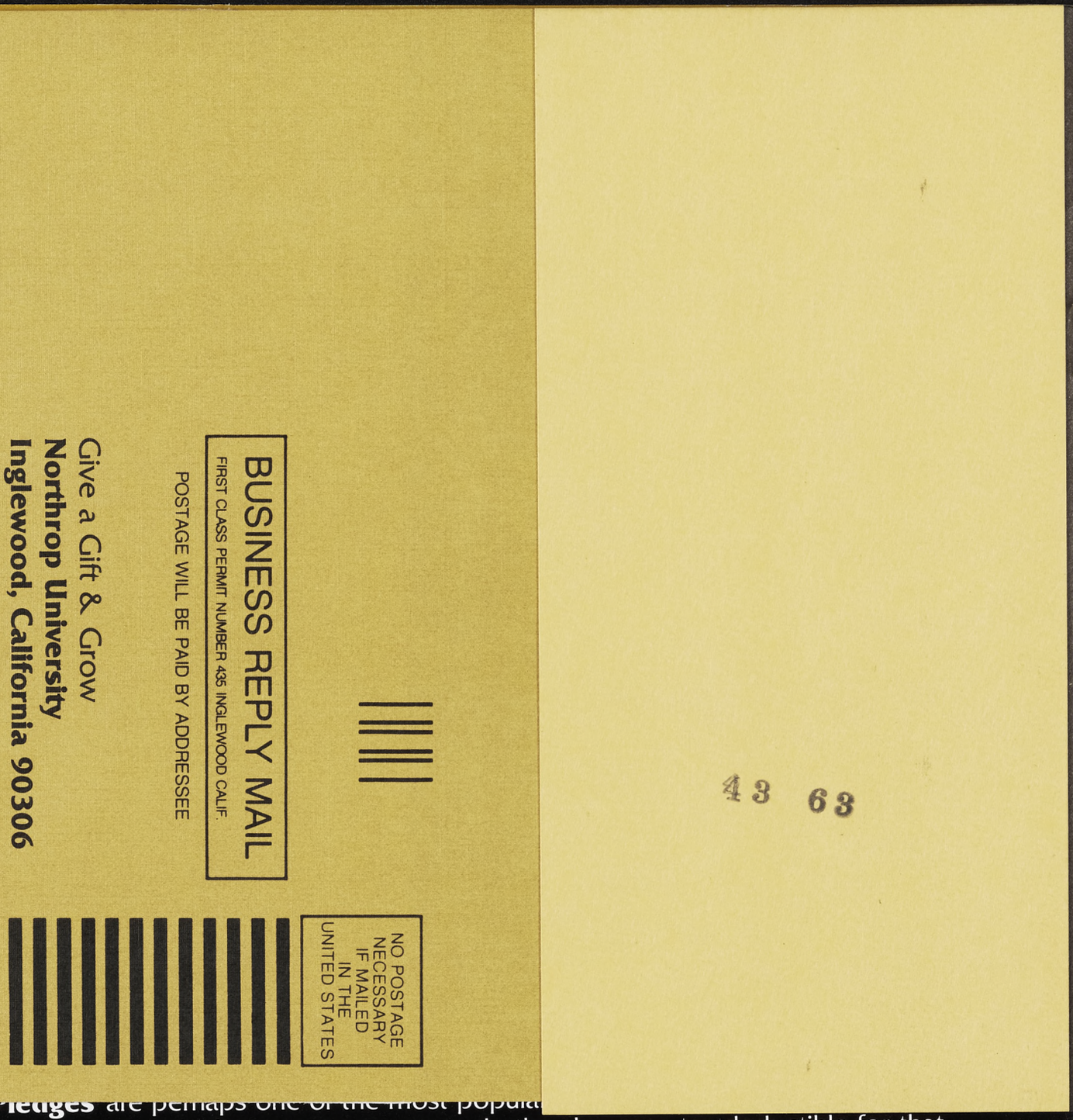
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